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Seasonal and Inter-annual signals in the Mediterranean Outflow observed in Espartel Sill (western Strait of Gibraltar) during the last decade

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The Espartel Section, located at 5°59‘W longitude in the Strait of Gibraltar, can be considered as the last gate of the Mediterranean Outflow (MOW) in its path to the North Atlantic Ocean. This section presents a submarine ridge called Majuan Bank (150 m depth) that divides the outflowing cross-section into two channels. The northern channel has a maximum depth of 250 m while the southern channel reaches depths of 360 m and forms the so-called Espartel Sill that represents the main exit for the Mediterranean outflow.

In this work, Acoustic Doppler Current Profiler (ADCP) velocity records and near-bottom temperature-salinity data, collected in Espartel Sill within the frame of the Spanish-founded INGRES projects, have been used to compute the MOW at the western end of the Strait of Gibraltar. This station was installed in September 2004 and it was visited in April 2011 for the last time so the currently available time series is seven years long. Datasets from this station have been used for estimating the MOW (and its hydrological properties) flowing throughout the channel.

The computed low-frequency Mediterranean Outflow has a mean value of - 0.77 $\pm$ 0.25 Sv (negative value denotes westward moving) and exhibits a clear seasonal signal along with an inter-annual cycle. Maximum values are observed in spring (April-May) in 2005, 2006 and 2009, whereas a weaker signal is achieved in 2007 and 2008. On the contrary, 2010 and 2011 exhibit stronger seasonality with transport peaking in late winter. Minimum transport values are reached in September-October for almost all years investigated. The annual signal is very clear in the temperature of the Mediterranean outflowing water, warmer in winter (January-February), cooler in late spring (May-June). This pattern is observed for all years investigated except for 2007 and 2008 where a secondary semi-annual signal superposes to the annual cycle. A weaker seasonal signal is also found in the salinity records, water being fresher in January and saltier in May-June. Both signals combine to give less dense Mediterranean outflowing water in winter than in summer.